

not at its upper extremities exceed 4000 feet above the ground ; and is led to the general conclusion, that the aurora borealis is situated in the region immediately above the clouds, and therefore varies much in height according to the different states of the atmosphere. He believes it to be an effect of the developement of electricity from the condensation of vapour. The position of the fringes, which are constantly at right angles to the magnetic meridian, their progressive movements from the north magnetic pole, and their influence on the needle whenever they come into the plane of the dip, are all of them circumstances which establish the relation of this phenomenon to magnetism ; while they at the same time illustrate the intimate connexion subsisting between magnetism and electricity.

*Remarks on several Icebergs which have been met with in unusually low Latitudes in the Southern Hemisphere. By Captain James Horsburgh, Hydrographer to the East India Company, F.R.S. Read February 4, 1830. [Phil. Trans. 1830, p. 117.]*

The journals of the ships belonging to the East India Company, the author observes, during the whole of the last century, contain no accounts of icebergs having been seen in the course of their navigation in the southern hemisphere, although several of these ships proceeded into the parallels of latitude  $40^{\circ}$ ,  $41^{\circ}$ , and  $42^{\circ}$  south ; but during the last two years, it appears that icebergs have occasionally been met with by several ships in their passage, very near the Cape of Good Hope, between the latitudes of  $36^{\circ}$  and  $39^{\circ}$ . The particulars relating to these observations are detailed in the paper. The most remarkable occurred in the voyage of the brig *Eliza*, from Antwerp, bound to Batavia, which on the 28th of April, 1828, fell in with five icebergs in latitude  $37^{\circ} 31'$  south, longitude  $18^{\circ} 17'$  east of Greenwich. They had the appearance of church steeples, of a height from 250 to 300 feet ; and the sea broke so violently against these enormous masses, that it was at first suspected they might be fixed upon some unknown shoal, until, on sounding, no bottom could be discovered.

It is remarkable that in general, icebergs appear to be met with in low latitudes, nearly at the same period of the year, namely, in April or May, in both the northern and southern hemispheres, although the seasons are reversed in these two divisions of the globe. In order to account for the origin and accretion of the southern icebergs, the author thinks it probable that there exists a large tract of land near the antarctic circle, somewhere between the meridian of London and the twentieth degree of east longitude ; whence these icebergs have been carried in a north and north-north-easterly direction, by the united forces of current, winds, and waves, prevailing from south-south-west and south-west. Bouvet's and Thompson's Islands are not of sufficient magnitude, and Sandwich Land and Kerguelen's Island are too remote to be the source of the icebergs lately observed in the vicinity of the Cape. From their unprecedented descent during the

last two years, it is most probable that the disruption of these masses of ice from the place of their formation was the effect of some powerful cause of rare occurrence, such as an earthquake or volcano, which has burst forth and convulsed the inaccessible regions of the south; leaving no other testimonials of the event, than some few fragments of ice, scattered at a distance in the Indian Ocean.

*On the progressive Improvements made in the Efficiency of Steam Engines in Cornwall; with Investigations of the Methods best adapted for imparting great angular Velocities.* By Davies Gilbert, Esq. P.R.S. Read March 4, 1830. [*Phil. Trans.* 1830, p. 121.]

The practical adaptation of the steam-engine to mechanical purposes is considered by the author as due to Mr. Newcomen, whose engines were introduced into Cornwall very early in the last century, and soon superseded the rude machinery which had till then been employed for raising water from the mines by the labour of men and of horses. The terms proposed by Mr. Watt, in virtue of his patent in 1769, which secured to him, until the year 1800, the receipts of one third of all the savings in fuel resulting from the adoption of his improvements in the construction of the engine, rendered it necessary to institute an accurate comparison between the efficiency of his with former engines. A copy of the report drawn up on this occasion, in October 1778, is given in the paper; but as the dynamic unit of one pound avoirdupois, raised through a height of one foot, had not yet been established as the measure of efficiency, the author, proceeding upon the data furnished by that report, calculates that the duty performed by Watt's engine, with the consumption of one bushel of coal, on that occasion was 7,037,800. In the year 1793, an account was taken of the work performed by seventeen engines on Mr. Watt's construction, then working in Cornwall, their average duty was 19,569,000; which exceeds the performance of the former atmospheric engines, in the standard experiments, in the proportion of 2.78 to 1. Some years afterwards, disputes having arisen as to the real performance of Mr. Watt's engines, the matter was referred to five arbiters, of whom the author was one; and their report, dated in May 1798, is given as far as relates to the duties of the engines. The general average of twenty-three engines was 17,671,000. Since that period, so great have been the improvements in the economy of fuel and other parts of the machinery, that in December 1829, the duty of the best engine, with a cylinder of 80 inches, was 75,628,000, exceeding the duty performed in 1795, in the proportion of 3.865 to 1; and that of the atmospheric engine of 1778, in the proportion of 10.75 to 1.

The remainder of the paper relates to the friction in machinery, and the different modes of obviating its effects. With a view of reducing the amount of friction, the author is led to consider what are the most proper forms for the teeth and cogs of wheels; and through what intermediate steps a given increase of angular velocity may be